Canadian Centre for Occupational Health and Safety

Centre canadien d'hygiène et de sécurité au travail

JOB DESIGN

How It Contributes to Occupational Health and Safety

P89-4E

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JOB DESIGN--HOW IT CONTRIBUTES TO OCCUPATIONAL HEALTH AND SAFETY

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PREFACE

This publication is part of a series on ergonomics. It is prepared as a source of information for health and safety committees and others with an interest in reducing occupational risks resulting from poor job design.

This publication focuses on the physical aspects of job design. Although it touches upon some of the issues of stress, this publication does not examine in depth the psychosocial issues of job design. Please refer to the Further Reading list. It contains suggestions for publications with detailed psychosocial information.

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1. INTRODUCTION

Job design and workplace design go hand in hand to ensure the health and safety of workers. Job design is the way that a set of tasks, or a job, is organized. Job design determines:

- what tasks are done
- how tasks are done
- how many tasks are done
- order in which tasks are done

Job design is ongoing. The idea is to make adjustments as conditions change within the workplace.

Good job design accommodates workers' mental and physical characteristics by paying particular attention to:

- muscular energy expenditure
- physical force requirements and body position
- stress

Good job design minimizes muscular fatigue and keeps energy expenditures within the limits of workers' abilities. The basic principle is to balance static and dynamic work.

Static work, such as holding a box at arm's length in front of the body, tenses or contracts muscles. Maintaining a fixed and sometimes awkward posture is physically demanding, requires energy and reduces the flow of blood to the muscles.

Dynamic work, such as digging a trench or scrubbing a floor, involves rhythmic contraction and relaxation of muscles. It also encourages blood flow which removes the body's waste products and provides the necessary oxygen and nutrients. But overuse of any body part leads to pain, strain, and possible injury.

Good job design keeps physical force requirements reasonable. Body positions that maximize strength while maintaining safety, minimize the demands put on the musculoskeletal system. Excessive or hazardous demands increase bending, twisting, overreaching, awkward body positions, lifting and carrying, and tasks with repetitive motions.

Good job design prevents harmful stress. Stress is the body's nonspecific response to any demand made upon it. It allows the body to tap energy stores needed to meet physical or mental demands.

Not all stress is harmful. Some stress is necessary to motivate and challenge individuals. Positive stress occurs when the demands of the job match the worker's skills and knowledge, and also the equipment and materials needed to do the job. Positive stress gives the worker a sense of achievement and self-esteem.

Characteristics of job design that determine whether stress is harmful or beneficial are:

- amount of control the worker has over tasks
- level of responsibility
- level of participation in task-related and general workplace activities
- amount and type of supervision
- extent to which roles are understood
- extent and nature of social support systems

This publication provides many suggestions for the occupational health and safety committee interested in good job design. The goal is to meld good job design and workplace design to ensure the health and safety of workers.

2. HEALTH AND SAFETY PROBLEMS

Back injuries and overuse injuries are two of the most widely recognized problems in the workplace. An overuse injury is an ongoing condition caused by the wearing down or deterioration of tissues that aid the body's movement. Rushed work, jerky or repetitive motions, twisting, reaching, bending and static work positions contribute to both back and overuse injuries. The checklist on page 3 identifies some more specific problems.

Long periods of work at visually demanding jobs such as VDT operation, especially when combined with poor workplace design, lead to eyestrain. (Refer to CCOHS Publication P89-22E, Ergonomics for Workplaces with Visual Display Terminals.)

Sitting in poorly designed and unadjusted seats or standing on hard floors for long periods causes blood circulation problems, and possibly varicose veins.

Stress resulting from poor job design leads to several problems. Workers may experience anxiety, depression, anger, loss of concentration, or sleeplessness. The immediate physical response can be tension, headache or upset stomach. In the longer term, stress can contribute to the development of heart disease, stomach disorders, respiratory problems, skin disorders and greater susceptibility to colds and flu. Abuse of drugs, alcohol, tobacco, and caffeine, and over- or under-eating, aggression, risk-taking and poor interpersonal relations may also occur.

Checklist--Job Design Hazards

Posture

Body--bent, twisted or unsupported?	yes__ no__
Neck--bent, tilted or twisted?	yes__ no__
Shoulders--hunched?	yes__ no__
Arms--elevated?	yes__ no__
Wrists--bent or twisted?	yes__ no__
Legs--pressure on back of knees or thighs?	yes__ no__

Movement

Joints--at extremes of their range of movement?	yes__ no__
Grips--difficult to grasp, too much strength required?	yes__ no__
Direction--movement awkward and not natural?	yes__ no__
Pushing or pulling--tasks that require great effort?	yes__ no__
Lifting--heavy or awkward loads?	yes__ no__

Duration of Movements

Repetitive tasks--same body parts used over and over?	yes__ no__
Static positions--few or no opportunities to change position?	yes__ no__
Fast work pace--muscle tension and stress?	yes__ no__

Work/Rest Schedules

Long work period--fatigue?	yes__ no__

3. FEATURES OF GOOD JOB DESIGN

Good job design:

- minimizes energy expenditure and force requirements
- balances static and dynamic work
- allows some decision-making so workers can vary activities according to personal needs, work habits, and the circumstances in the workplace
- gives workers a sense of accomplishment
- includes training so workers know what tasks to do and how to do them
- provides good work/rest schedules
- allows an adjustment period for physically demanding jobs
- provides feedback to the workers about how they are doing

4. STEPS TOWARD GOOD JOB DESIGN

Achieving good job design involves administrative practices that determine what the worker does, for how long, where and when. Here are the steps that the occupational health and safety committee should advocate to managers, supervisors and workers.

Vary Body Positions and Movements

Avoid static body positions and repetitive movements to alleviate boredom. Design jobs with varied tasks that require changes in body position, muscles used, and mental activities. Two methods of doing this are job enlargement and job rotation.

Job enlargement redesigns jobs to include more and different tasks. This increases the variety of motions and the time between repeated motions. Job enlargement adds interest to the work and may give workers more responsibility.

Job rotation moves workers from one job to another. It distributes the load of stressful jobs among a group of workers. It also reduces the time each worker spends in one position and the number of repetitions of the same motion. Job rotation can provide relief only if the various tasks use different muscle groups. An example is a job that allows the worker to sit instead of stand.

Optimize Work/Rest Schedules

All work schedules, especially rotating shift work and the extended workday schedules, must be well designed. (For more information refer to CCOHS publications P87-2E, Rotational Shift Work--A Summary of the Adverse Effects and Improvement Strategies and P87-9E, The Extended Workday--Health and Safety Issues.)

Rest breaks help alleviate the problems of unavoidable repetitive movements or static body positions. Frequent short breaks are sometimes preferable to fewer long breaks.

During rest breaks, encourage workers to change body position and to exercise. It is important that workers stretch and use different muscle groups.

Allow for an Adjustment Period

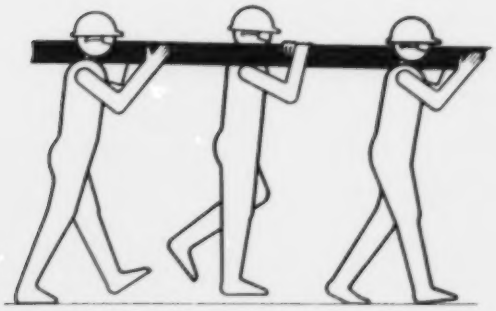
When work demands physical effort, have an adjustment period for new workers and for all workers after holidays, layoffs, or illnesses. Allow time to become accustomed to the physical demands of work by gradually "getting in shape."

Provide Training

Training in correct work procedures and equipment operation is needed so that workers understand what is expected of them and how to work safely. Training should be organized, consistent and ongoing. It may occur in a classroom or on the job.

Ensure There are Enough Workers to Complete Tasks Safely

Avoid injuries by having more workers help with tasks such as lifting.



- Determine the number of workers needed according to the load's weight and size.
- Identify one worker as leader to plan and explain the entire move.
- Have the leader position workers carrying the load to ensure good weight distribution.
- Ask workers to raise and lower load on the leader's command.

Vary Work Tasks to Vary Mental Activities

Coordinate tasks so they are balanced. Balance the workload among workers.

5. WORKPLACE DESIGN

While workplace design is not by definition part of job design, it tackles some of the same issues as job design. Good workplace design reduces static or repetitive motions and awkward body positions. The occupational health and safety committee might wish to give the following advice:

Reduce Strain of Working in One Standing Position

- Use a footrest or rail to shift weight from one leg to the other.
- Soften hard floors with a mat.
- Sit during rest breaks.

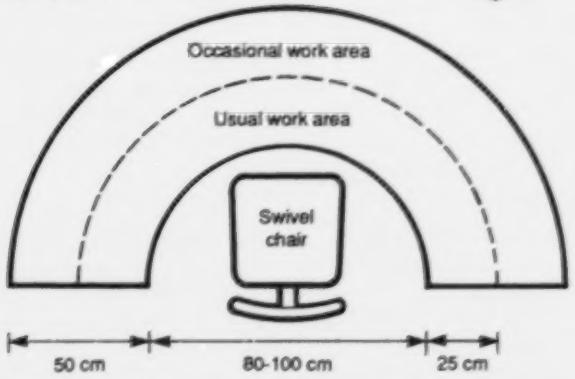
Reduce Strain of Working in One Sitting Position

- Use an adjustable chair with good back support.
- Readjust chair throughout the day to change body position.
- Use a footrest to support dangling feet and to help change body position.
- Stand or walk around during rest breaks.

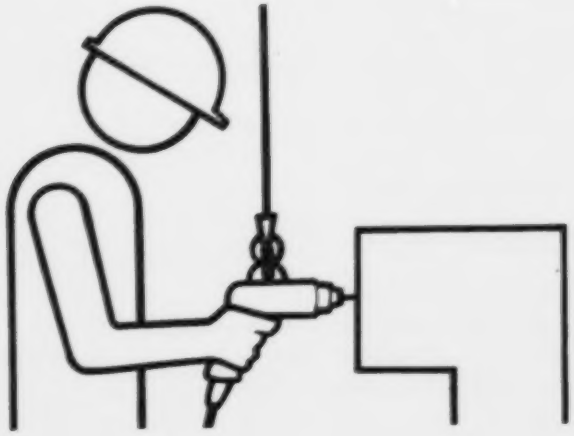
Choose the Best Tool for the Task

- Choose well-designed tools and equipment that minimize twisting. Frequent work with an ordinary screwdriver requires repeated twisting with a bent wrist. This motion can lead to hand, wrist, arm or shoulder injury. The "Yankee drill" is designed to eliminate this hazardous motion by rotating the screwdriver blade when pushed forward.

- Keep tools and equipment within reach.



- Use tools and equipment designed to reduce the strength required. Suspending a heavy tool reduces the static effort of the arm muscles.

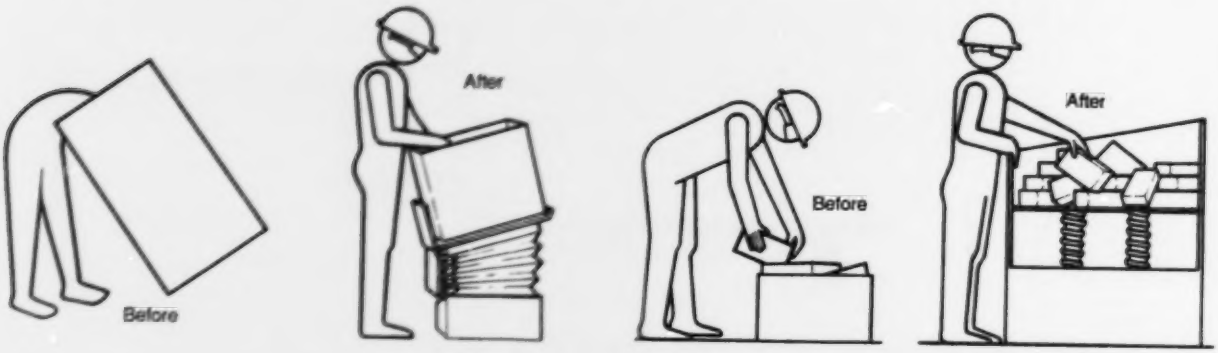


Position Tools Well

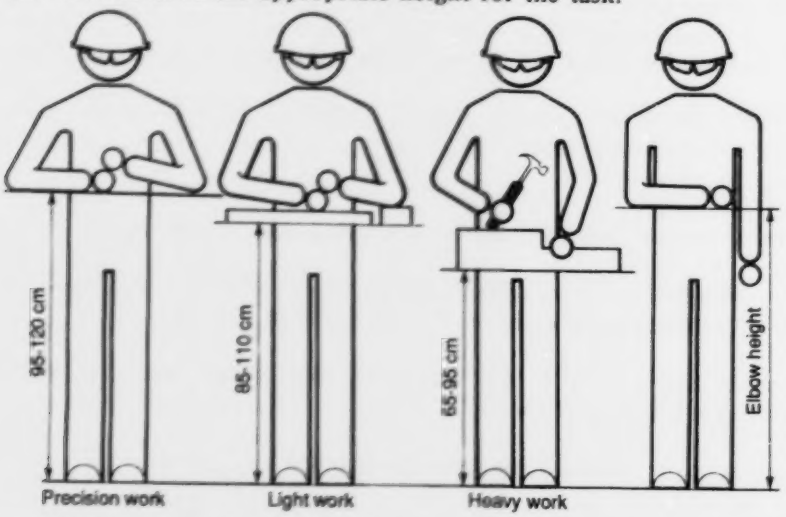
- Avoid awkward positions, such as a bent wrist or twisted arm. Too much energy is required to hold these positions, and this can result in pain and injury.
- Place tools, machine controls, materials, work pieces and other heavy objects as near the worker as possible and within normal reach.

Avoid Bending, Twisting and Overreaching

- Use lift tables, work dispensers and similar mechanical aids.



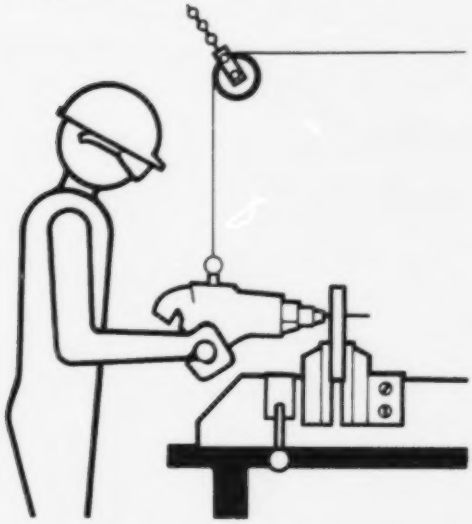
- Position the work level to the appropriate height for the task.



- Keep materials at work level. Do not lower anything to the floor that must be lifted later.
- Use conveyors, chutes, slides or turntables to move materials.
- Use adjustable swivel chairs.
- Allow enough space for the whole body to turn.
- Turn by moving feet rather than twisting the body.

Choose Work Stations that Fit the Worker and Suit the Task

- Choose adjustable work stations and seats to accommodate workers of varying shapes and sizes.



Minimize Hazards of Lifting and Carrying

- Reduce the size of cartons or pallets or provide space to walk around large objects. Alternatively, provide equipment that rotates the carton or pallet to avoid strains from reaching over or around large objects.
- Use lift tables, lift trucks, cranes, hoists, balancers, drum and barrel dumpers, work dispensers, elevating conveyors, and gravity dumps and chutes to move material.
- Put many objects in one large container or on pallets, and use lift trucks.
- Reduce the weight of the lifted object by reducing the size of the object, capacity of containers, or number of objects moved at once.
- Make objects easier to lift by changing the shape of the object and by using handles and grips on containers.
- Redesign work areas to minimize the carrying distance.

6. STAGES IN A JOB DESIGN PROJECT

Although there are many ways to carry out job design, the following stages are essential. The occupational health and safety committee might wish to call for them specifically.

- Do a task analysis. Examine the job and determine exactly what the tasks are. Consider what equipment and work station features are important for completing the tasks. Identify problem areas.

- Design the job. Identify the methods for doing the work, work/rest schedules, training requirements, equipment needed and workplace changes. Coordinate the different jobs so each one varies mental activities and body position. Be careful not to under or overload the job.

- Implement the new job design gradually. Train workers in the new procedures and use of equipment. Allow for an adjustment period and time to gain experience with the new job design.

- Re-evaluate job design on a continual basis. Make any necessary adjustments.

The occupational health and safety committee should involve workers and managers in the entire job design process. Participation of all parties involved increases communication and understanding of the important issues that the job design should address.

7. CONCLUSION

Good job design is essential for preventing and solving occupational health and safety problems. The aim is to encourage good and varied body positions, reasonable strength requirements, and feelings of achievement and self-esteem. By blending good administrative practices and workplace design, good job design maintains and promotes health and safety.

Careful planning and the cooperation of all involved are essential to good job design.

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